Preparing As-Built Drawings

Scope

This instruction covers preparing high-quality As-Built drawings to show changes made to the project during construction. As-Built drawings are an official record of the project at the time of construction completion. The original "as-designed" contract drawings and specifications are modified to show all additions, deletions and other changes made during construction. Accurate as-built drawings are very important for project operation and maintenance, and future modifications, particularly for plumbing and electrical systems, which are hidden from view.

References

- *CADD/GIS Technology Center Architectural, Engineering, and Construction (A/E/C) CADD Standards[http://tsc.wes.army.mil/products/standards/aec/intro.asp]*

Definitions.

See the *Glossary of Engineering Quality System Terms and Acronyms [REFQ10L0]*, for definitions.

Contractor Markups - Drawings that are marked and annotated to show the project As-Built and constructed by the contractor. They are part of the working as-built set.

As-Built Drawings - The amended "As-designed" drawings revised to show the project as the contractor built and constructed it. The revisions from Contractor Markups and field inspection notes are transferred to the Final as-built set of drawings. The final as-built drawings include modifications during construction, field requested changes, shop drawing modifications, and contractor designs.

As-Constructed Drawings - These are As-Built Drawings for Civil Works Projects. The term As-Built used in these instructions is synonymous.

Working As-Built

The Contractor shall maintain 2 sets of paper drawings and specifications (marked-up prints) to track changes, additions or deletions from the original design during construction. Working as-built drawings shall be kept current on a weekly basis and at least one paper set of as-built drawings shall be available on the jobsite at all times.

Areas of Concern

There are some general items that need some special checking to ensure that the marked-up prints are complete and accurate. The working as-built shall show, but shall not be limited to, the following:

(1) The actual location, kinds and sizes of all of existing and new utility lines, especially underground lines within the construction area. Measurements will be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, etc. The descriptions of exterior utilities shall include the actual quantity, size, and material of the utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

(2) The location and dimensions of any changes within the building structure.

(3) Layout and schematic drawings of electrical circuits and piping.

(4) Correct dimensions and details transferred from shop drawings.

(5) Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

(6) Actual location of anchors, construction and control joints, etc., in concrete.

(7) Changes in location of equipment and architectural features.

(8) Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints. Cross out such words and phrases as "optimal requirement," "or equal," etc., and list specifically the items of material provided.

(9) Unusual or uncharted obstructions that are encountered in the contract work area during construction.

(10) Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

(11) Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

(12) The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

(13) If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

(14) Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems

(15) Changes or modifications that result from the final inspection.

Mark-up Guidelines

The following information is provided to improve the quality of the marked-up prints and thereby facilitate preparation of final as-built drawings. The most important guideline is that the marked-up changes on the prints shall be complete and understandable. Visits to the site by the draftsperson, or visits to the draftsperson by the construction superintendent, can be minimized by providing complete and understandable marked-up prints.

(1) Frequently use written explanations on As-Built drawings to describe changes - do not rely totally on graphic means to convey the revision.

(2) Legibility of lettering and digit values shall be precise and clear when marking prints, and clarify ambiguities concerning the nature and application of change involved.

(3) Wherever a revision is made, make changes to affect related section views, details, legend, profiles, plans and elevation views, schedules, notes and call-out designations, and mark accordingly to avoid conflicting data on all other sheets.

(4) When changes are made, cross out all features, data and captions that relate to that revision.

(5) When changes are required on small-scale drawings and in restricted areas, suggest large-scale inserts be drawn or sketched, with leaders to the location where applicable.

(6) Provide a legend if colors other than the "base" colors of red, green, and blue are used. Be sure descriptive markings conform to legend symbols shown.

(7) Be sure to add and denote in legend, any additional equipment or material facilities, service lines, etc., incorporated under As-Built Revision if not already shown in legend.

(8) When attached prints (or sketches) are provided with marked-up print, indicate whether:

a. Entire drawing shall be added to contract drawings or

b. Whether the contract drawings shall be changed to agree, or

c. For reference only to further details not required for initial design.

(9) Make the comments on the drawing complete without reference to letters, memo's, or materials that are not also a part of the As-Built. Annotating the drawing, “Per Change Order #42,” means nothing when the actual change order states, “added an additional 12 duplex” outlets or similar statements. The same is true when the drawing is marked,

"changed per COE instructions." This office and ultimately the using organizations must know what was changed, how it was changed, where the items(s) were relocated to and how the affected connections were altered. Change Orders usually do not provide information as to how the facility was changed, only what was changed.

(10) The markups shall be accomplished on blue or black line prints of the **most current originals**.

(11) Shop drawings are to be incorporated into the As-Built drawings. They will be provided in electronic CADD file format and conform to the Sacramento District CADD Standards and the A/E/C CADD Standards. Hand drawn or plotted paper shop drawings **will not** be accepted as submittals.

The hand drawn or plotted paper shop drawings are **not** usable as original drawings for several reasons.

a. The "shop drawings" are not reproducible in blue line form.

b. The drawings are not of an adequate scale or are drawn to no scale and are not transferable to the CORPS drawings due to lack of information.

c. The limited numbers of reproducible shop drawings that have been received have not been on the Corps of Engineers standard sheets sizes making it difficult to convert these drawings to standard COE drawings.

Any drawing provided by non-COE sources will be drawn in CADD. Sheets shall be drawn at the same scale as similar drawings in the set (example: Fire alarm systems shall be drawn to the same scale as the plumbing or electrical drawings). The drawing shall meet the same standards required for the rest of the drawings set. Sheet number, detail number, etc shall tie details and sketches to existing drawings.

FINAL AS-BUILT DRAWINGS

The contractor will transfer the changes from the working as-built marked prints to the original electronic CADD files. Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The Resident Engineer and the Contractor will jointly review the working as-built marked prints, printouts from working as-built CADD file drawings, and final as-built drawings for accuracy and completeness, prior to submission of each monthly pay estimate. Monthly review of working as-built CADD printouts shall at minimum cover all sheets revised since the previous review.

DRAFTING STANDARDS

The Corps requires that standard professional engineering drafting practices be utilized in correcting the original electronic CADD drawings to show as-built conditions. In general, the letter styles, line thickness, and scale will be the same as the original drawings. When shop drawings or other sheets are added, they will be drawn in electronic CADD.

CADD Standards: File Naming Convention will be maintained on all existing CADD files and followed for any new files added. The Contractor shall revise CADD files as-built drawing layers, to show the as-built conditions during the prosecution of the project. All as-built "triangle" changes shall be on a separate single layer, using a single color, with an associated medium pen width.

- Name the layer AS-BUILT for AutoCAD files (DWG).

- MicroStation files (DGN) use:
  - Level #63
  - Level/Layer Name contains: ANNO-REVS
  - Level/Layer Description: Revisions

The following specific requirements apply to the preparation of as-built drawings:

The Title Sheet (first sheet): The first sheet will be labeled with the word AS-BUILT. The words CONTRACT NUMBER and the actual contract number will be entered as shown on attachment 1. The contract number contains the Fiscal Year, the letter C (for construction), and the sequence number (example: 96-C-0000). No other work need be done on this sheet unless sheets are being added or deleted from the List of Drawings or other actual changes are made on this sheet. (See Attachment 1.)

The second and subsequent sheets: All the sheets following the title sheet will be labeled with the AS-BUILT stamp. (See Attachment 2.)

Signature representation (CADD files only): All signatures that appear on the approved original design drawings need to be represented on all the electronic as-built files. The format for these are /s/Name (i.e. /s/Raymond Dennis). The only name that does not require the /s/ is the District Commander's name that appears only on the cover sheet (the title sheet). (See Attachments 1 & 2.)

Revisions Block entries: Those sheets, which have no changes, will only be labeled AS-BUILT as described above. Those sheets which have changes shown on them will have REVISED AS-BUILT entered in the first available space. This will be revision one and a number 1 will be entered in the triangle at the beginning of that line. In the event the sheet has already been revised and a number and revision appear in the revision lines the next sequential number will be used. Normally the first entry is made in the first line. The completed originals CADD file drawings will be reviewed for accuracy and initialed by the Contractor. (See Attachments 2 & 3.)

Marking Revisions: Place an equilateral triangle (3/8" per side) near the area revised for all changes. One triangle may be placed near the table or detail title where several items in a table or detail are changed or completely redrawn. This same method may be used for general revisions to floor plans and system plans (plumbing, electrical, a/c, heating); when a major portion of the drawing is changed, the triangle may be placed near the diagram, detail, section or plans title. A triangle will be placed near each item when only a few items are revised, added or

deleted. The triangles will contain the same number as the As-Built revision on that sheet. (See Attachment 4.)

Revision Annotations:

Deletion - to show an item was not installed, cross the item out on the drawing along with any associated devices, connecting lines, ducts, pipes etc., including notes and dimensions. To show a detail is not being used, box the detail and letter NOT USED across the detail. A box will be drawn on the sheet with an X as shown in Attachment 5. The words NOT USED will be in heavy block lettering a minimum of 5/8" high. Place a triangle and revision number inside the box where notes are indicated as not being used.

Notes - draw a line thru the note or line item in a table in lieu of erasing the line item or note. A triangle and number will be placed near the deleted item.

Additions - show a new or additional item or items and associated connections made if the print indicates such connections. A triangle and number will be placed near the new item. All lettering **will conform** to the existing lettering on each sheet.

Relocations - draw the item in the new location and erase it from the old location. All connections will be transferred if applicable, such as wiring, piping, and ducts. Revision triangles with appropriate number will be shown at the new and old location.

Drawing continuity: The applicable drawings shall be marked-up when a change was made, although this will not always be the case. Final responsibility for drawing continuity is with the person doing the As-Built. When one floor plan indicates a wall, room, doors etc., has been changed, the same change shall be made on all other applicable drawings. When the change is applicable to only one discipline such as electrical and does not directly affect other discipline sheets, a note may be added to other discipline sheets such as "See sheet _____ for As-Built Conditions."

Shop drawings: When shop drawings are added to the original contract drawing set they need to be appropriately labeled with the Sacramento District file number, and discipline and sequence sheet number. The Index of Drawings will also need to be revised to show the additional sheet (s) with the appropriate sheet title. In the case where the shop drawing are smaller than the Corps standard sheet size (i.e. 8.5"x11" or 11"x17" etc.) the sheets will be cut into a standard Corps sheet size border sheet and appropriately labeled. (For additional information refer to Mark-up Guidelines, Shop drawings above.)

Distribution

Archives Unit

Contractor*

Resident Engineer*

Specification Engineer

Ownership

The Archives Unit [Raymond.E.Dennis@usace.army.mil?Subject=INSP05L0-Preparing As-Built Drawings] is responsible for ensuring that this document is necessary and that it reflects actual practice.

Activity Preface

These tasks are performed whenever changes, additions or deletions from the original "as-designed" contract drawings and specifications are made during construction.

Prior Activity

Creation, Packaging, and Delivery of Project Documents [PROP09L0]

Contractor

1. Print two sets of paper drawings and specifications for working as-built.

   The Contractor shall maintain 2 sets of paper drawings and specifications (marked-up prints) to track changes, additions or deletions from the original design during construction.

2. Mark working as-built set to show changes, additions or deletions.

   Place an equilateral triangle (3/8" per side) near the area revised for all changes. One triangle may be placed near the table or detail title where several items in a table or detail are changed or completely redrawn. This same method may be used for general revisions to floor plans and system plans (plumbing, electrical, a/c, heating); when a major portion of the drawing is changed, the triangle may be placed near the diagram, detail, section or plans title. A triangle will be placed near each item when only a few items are revised, added or deleted. The triangles will contain the same number as the As-Built revision on that sheet. (See Attachment 4.)

   Changes, additions or deletions **will immediately** be noted on each of the working as-built set by redline process. **No other** marks, doodles, notes, or annotations shall be put on these sets of working as-built prints. All changes from the contract plans, which are made in the work, or additional information which might be uncovered in the course of construction will be accurately and neatly recorded as they occur by means of details and notes.

   All changes and/or required additions to the paper prints will be clearly identified in color contrasting to black, as follows:

   Colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

   (1) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

(2) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

(3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

The working as-built sets will be annotated in as much detail as necessary to clarify exactly what construction changes were performed.

3. Transfer the changes from the working as-built marked prints to the "as-designed" electronic CADD files.

   The contractor will transfer the changes from the working as-built marked prints to the original electronic CADD files on a monthly basis. Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project).

If Project feature complete, goto task #4. Otherwise, goto task #2.

4. Submit As-Built drawings for review.

   The contractor shall submit the Final As-built conditions on a new CD to the Resident Engineer in the customer specified electronic format as a Government, District Office Approval (G, DO) required submittal.

Resident Engineer

5. Review As-Built drawings.

   The Resident Engineer and the Contractor will jointly review the working as-built marked prints, printouts from working as-built CADD file drawings, and final as-built drawings for accuracy and completeness, prior to submission of each monthly pay estimate. Monthly review of working as-built CADD printouts shall at minimum cover all sheets revised since the previous review.

If As-built OK, goto task #7. Otherwise, goto task #6.

6. Note required corrections on submittal and return to Contractor.

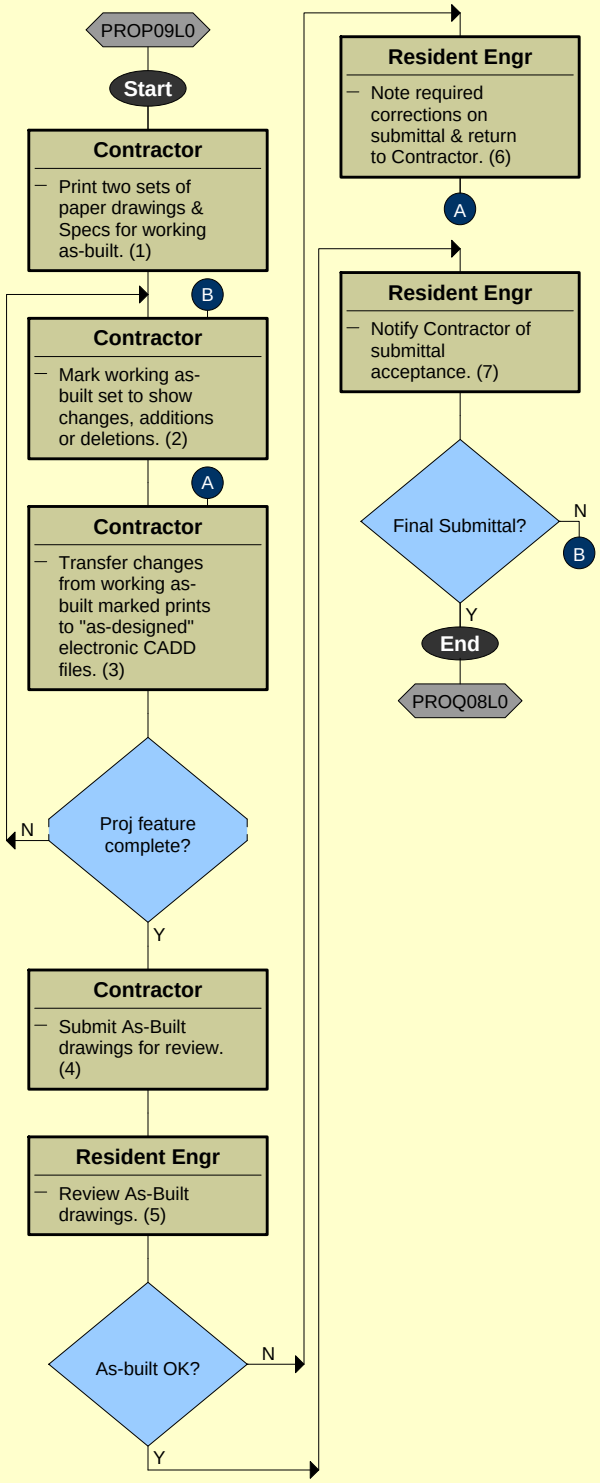
Goto task #3.

7. Notify Contractor of submittal acceptance.

If Final Submittal, End of activity; Goto *Managing As-Built & As-Constructed Drawings [PROQ08L0]*. Otherwise, goto task #2.

Flow Chart

Preparing As-Built Drawings



2

1

PRIMARY LOCATION

ALTERNATE LOCATION

AS-BUILT
CONTR. NO: XX-C-XXXX

AS-BUILT
CONTR. NO: XX-C-XXXX

AS-BUILT
CONTR. NO: XX-C-XXXX

Approved Functional Adequacy /s/PRINTED NAME MM/DD/YY Title Date	Designed by DESIGNER	Drawn by DRAFTER	Approved /s/PRINTED NAME MM/DD/YY Chief, Engineering Division Date
Prepared by A/E NAME AND ADDRESS /s/PRINTED NAME MM/DD/YY Title Date	Spec No. SPEC	Design File No: FILE	Prepared Under the Direction of COMMANDERS NAME Col, Corps of Engineers District Engineer
	File Name FILE_NAME	Plot Date PLOT_DATE	

BASE_NAME STATE

PROJECT_TITLE_1
PROJECT_TITLE_2

SHEET_NAME
SHEET_NAME_2
SHEET_NAME_3

Sheet reference number:
SHT#
SEQ#

UPDATE

2 1

Initals of person checking revisions
Initals of person doing revisions

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date Approved
1	DESCRIPTION1	DATE APPROVAL1
2	DESCRIPTION2	DATE APPROVAL2
3	DESCRIPTION3	DATE APPROVAL3
4	DESCRIPTION4	DATE APPROVAL4
5	DESCRIPTION5	DATE APPROVAL5
6	DESCRIPTION6	DATE APPROVAL6
7	DESCRIPTION7	DATE APPROVAL7
8	DESCRIPTION8	DATE APPROVAL8

Designed by: DESIGNER | Date: DATE_APPROVED | Rev.: REV_#
Drn by: DRAWN_BY | Ckd by: CHECKED_BY | Design file no: FILE_NO.
Reviewed by: REVIEWED_BY | SPEC. No.: SPEC_NO
Submitted by: SIGNATURE CHIEF | File name: FILE_NAME; Plot date: PLOT_DATE; Plot scale: PLOT_SCALE

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

A/E NAME AND ADDRESS

BASE_NAME
STATE
PROJECT_TITLE_1
PROJECT_TITLE_2
SHEET_NAME
SHEET_NAME_2
SHEET_NAME_3

Sheet reference number
SHT#
SEQ#

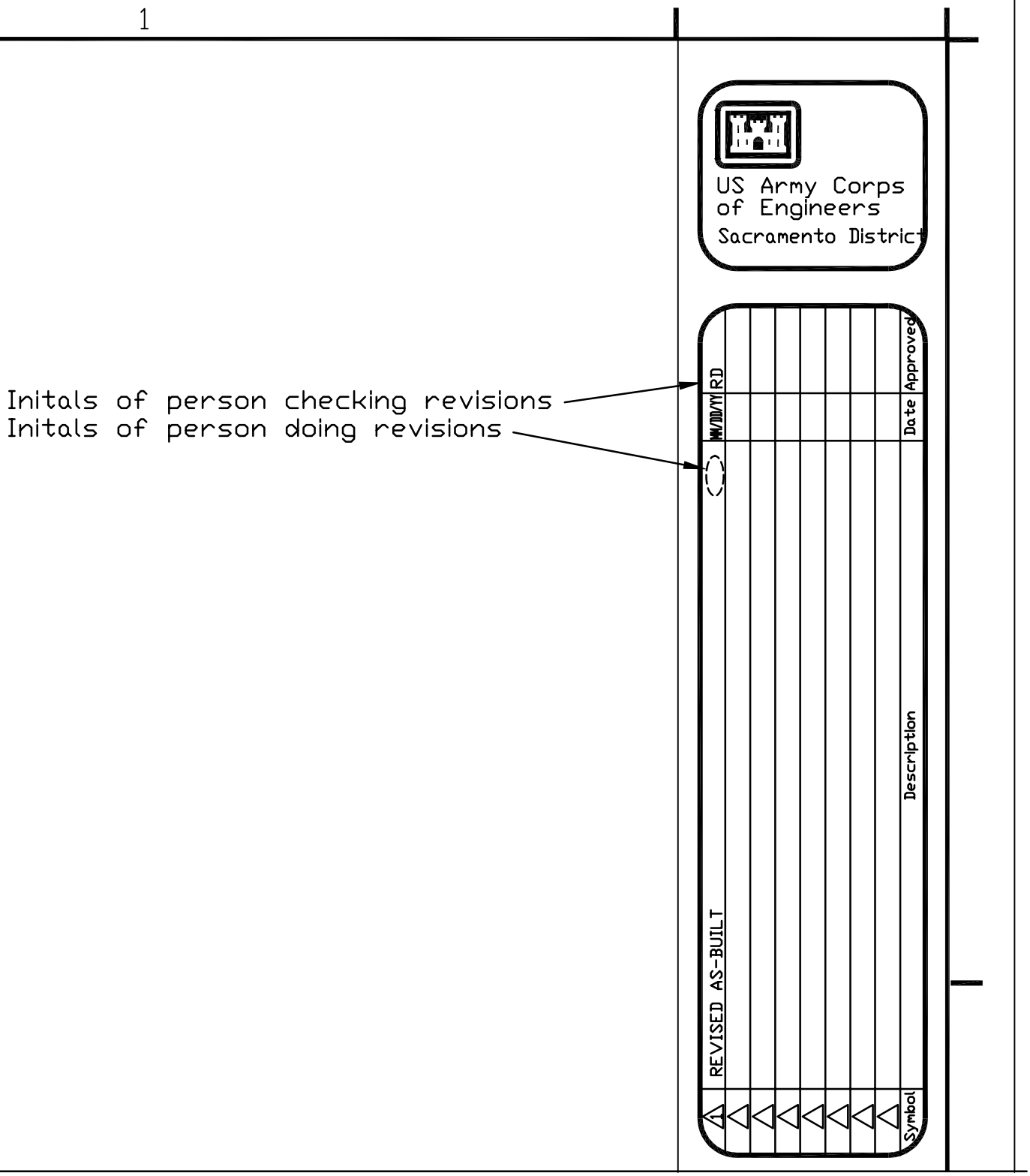
AS-BUILT

PRIMARY LOCATION

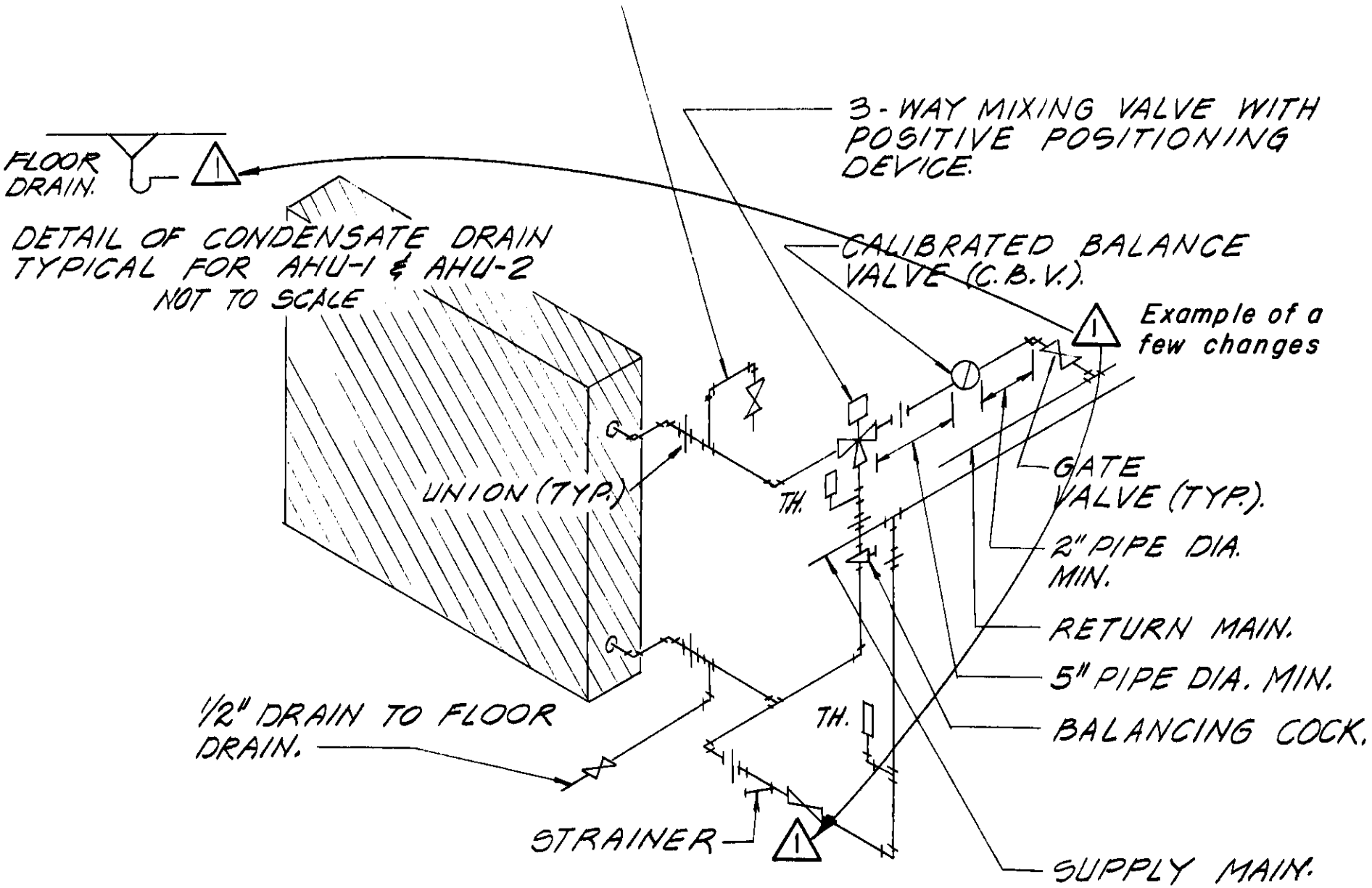
ALTERNATE LOCATION

AS-BUILT

Attachment 2



Attachment 3

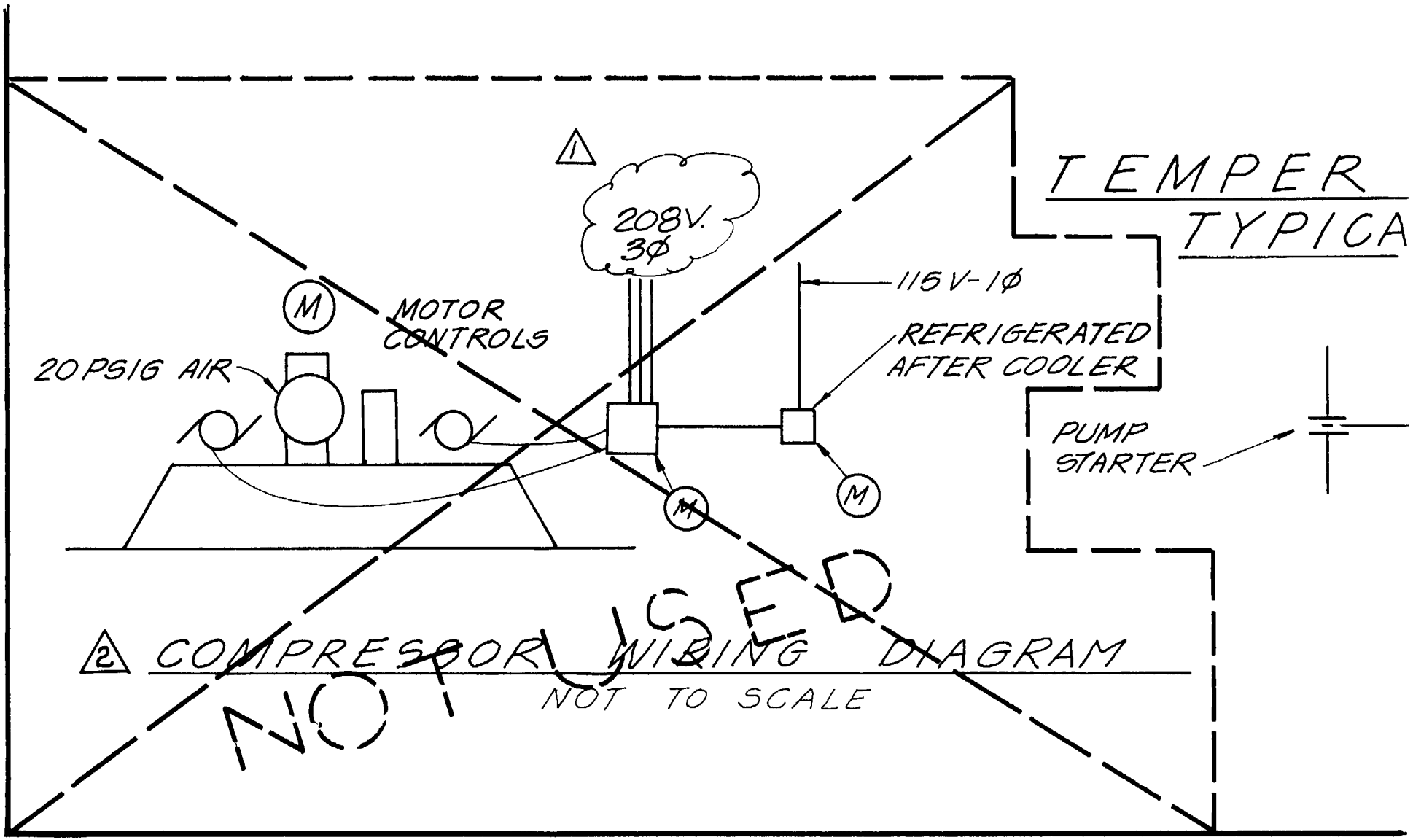


TYPICAL CONNECTIONS TO CHILLED WATER COILS.

NOT TO SCALE

1 Example of general revisions

Attachment 4



When an entire Detail, Section or View has been deleted it is indicated. Solid heavy lines are drawn on the back side of the sheet. "VOID" or "NOT USED" is lettered on the front. Dashed lines shown here for clarity.